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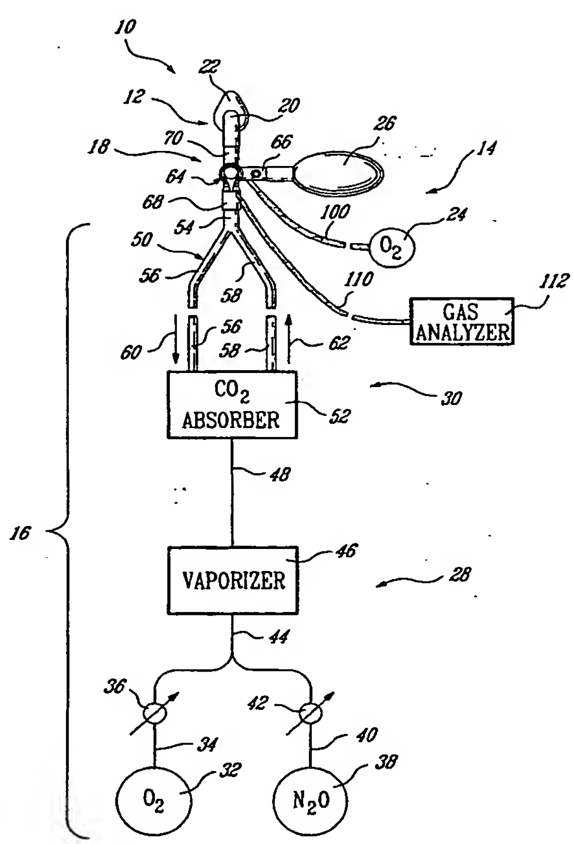
(54) Title: SINGLE BREATH INDUCTION ANESTHESIA APPARATUS



(57) Abstract: A single breath induction anesthesia apparatus (10) for anesthetising a patient, comprises a gas delivery system (12) for delivering at least one gas to the patient, an oxygen supply system (14) for providing oxygen, and an oxygen/anesthesia gas supply system (16) for mixing oxygen and at least one anesthesia gas at a preset optimum ratio sufficient to cause anesthesia of the patient with a single breath, thereby providing an oxygen/anesthesia gas mixture. The apparatus (10) of the invention further includes a valve (18) for providing selective gas flow communication between the oxygen supply system (14) and the gas delivery system (12) or between the oxygen/anesthesia gas supply system (16) and the gas delivery system (12). The valve (18) is operable for first establishing gas flow communication between the oxygen supply system (14) and the gas delivery system (12) to deliver oxygen to the patient and permit pre-oxygenation thereof, while inhibiting gas flow communication between the oxygen/anesthesia gas supply system (16) and the gas delivery system (12) to allow the oxygen/anesthesia gas mixture to reach the preset optimum ratio, and thereafter establishing gas flow communication between the oxygen/anesthesia gas supply system (16) and the gas delivery system (12) to deliver the oxygen/anesthesia gas mixture to the patient and permit single breath induction anesthesia thereof, while inhibiting gas flow communication between the oxygen supply system (14) and the gas delivery system (12).

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SINGLE BREATH INDUCTION ANESTHESIA APPARATUS

Technical Field

The present invention relates to improvements in the field of anesthesia. More particularly, the invention is concerned with a single breath induction anesthesia apparatus. Single breath induction anesthesia is also often referred to in the litterature as vital capacity induction anesthesia.

Background Art

When it is necessary to anesthetise a patient, it is highly desirable to pre-oxygenate the patient prior to inducing anesthesia in order to increase the pulmonary alveolar partial pressure in oxygen so as to increase the safety of the induction anesthesia as well as of a subsequent ventilation and endotracheal intubation. Pre-oxygenation of the patient is carried out by using a parallel oxygen supply and breathing system connected by means of a conduit to a face mask affixed to the patient. Due to the complexity of such a technique, pre-oxygenation is often skipped.

In the case where pre-oxygenation is effected, while the patient is being pre-oxygenated, the doctor usually closes with his hand the distal end of the conduit connected to an anesthesia machine and adapted to deliver an oxygen/anesthesia gas mixture to the patient, during operation of the anesthesia machine, so as to permit the anesthesia gas in the mixture to reach a preset concentration sufficient to induce anesthesia of the patient with a single breath. Since it is often impossible to close with one's hand the anesthesia gas conduit in a gas-tight manner, leaks of anesthesia gas can occur, which pollute the operating room. In addition, since the doctor has only one hand free, he is limited in his movements to perform other tasks. When the desired concentration of anesthesia gas has been reached, the oxygen conduit is disconnected from the face mask and the anesthesia gas conduit connected thereto. Alternatively, the face mask which is connected to the oxygen supply and breathing system is removed and another face mask to which the anesthesia gas conduit has been connected is affixed to

the patient. After induction of anesthesia, the face mask is then removed from the patient's face to permit the installation of a ventillation device such as an oropharyngeal airway, an endotracheal tube or a laryngeal mask. During these disconnection and connection of conduits and removal of the face mask, important leaks of anesthesia gas occur, which significantly pollute the operating room.

Disclosure of the Invention

It is therefore an object of the present invention to overcome the above drawbacks and to provide a single breath induction anesthesia apparatus which readily permits pre-oxygenation of the patient and single breath induction anesthesia thereof, without causing pollution of an operating room with anesthesia gas.

In accordance with the invention, there is thus provided a single breath induction anesthesia apparatus for anesthetising a patient, comprising gas delivery means for delivering at least one gas to the patient, and an oxygen supply system for providing oxygen and an oxygen/anesthesia gas supply system for mixing oxygen and at least one anesthesia gas at a preset optimum ratio sufficient to induce anesthesia of the patient with a single breath, thereby providing an oxygen/anesthesia gas mixture. The apparatus of the invention further includes a valve for providing selective gas flow communication between the oxygen supply system and the gas delivery means or between the oxygen/anesthesia gas supply system and the gas delivery means. The valve is operable for first establishing gas flow communication between the oxygen supply system and the gas delivery means to deliver oxygen to the patient and permit pre-oxygenation thereof, while inhibiting gas flow communication between the oxygen/anesthesia gas supply system and the gas delivery means to allow the oxygen/anesthesia gas mixture to reach the preset optimum ratio, and thereafter establishing gas flow communication between the oxygen/anesthesia gas supply system and the gas delivery means to deliver the oxygen/anesthesia gas mixture to the patient and permit single breath

induction anesthesia thereof, while inhibiting gas flow communication between the oxygen supply system and the gas delivery means.

According to a preferred embodiment, the valve comprises a valve body having a first port in gas flow communication with the oxygen supply system, a second port in gas flow communication with the oxygen/anesthesia gas supply system and a third port in gas flow communication with the gas delivery means, and a valve member within the valve body. The valve member is movable between a first position whereat the first port is in gas flow communication with the third port and the second port is closed, and a second position whereat the first port is closed and the second port is in gas flow communication with the third port. Preferably, the valve body has first, second and third tubular branches, the first, second and third ports being defined at respective proximal ends of the first, second and third tubular branches, respectively.

According to another preferred embodiment, the second and third ports are generally disposed along a first axis and the first port is generally disposed along a second axis extending transversely of the first axis. The second and third tubular branches extend along the first axis and the first tubular branch extends along the second axis. In such an embodiment, the valve member preferably has a T-shaped gas passage formed therein.

According to a further preferred embodiment, the first and second ports are generally disposed along a first axis and the third port is generally disposed along a second axis extending transversely of the first axis. The first and second tubular branches extend along the first axis and the third tubular branch extends along the second axis. In such an embodiment, the valve member is preferably rotatably mounted in the valve body for movement about a rotation axis which is co-axial with the second axis.

According to yet another preferred embodiment, the valve includes stop means for arresting the movement of the valve member at each

of the first and second positions. Preferably, the stop means each comprise cooperating abutment means disposed on the valve member and the valve body.

According to still another preferred embodiment, the first tubular branch is provided with gas vent means for venting excess oxygen, or venting gases exhaled by the patient during pre-oxygenation when the valve member is in the first position. The first tubular branch preferably comprises a first tubular section and a second tubular section which is removably connected to the first tubular section by means of a bayonet-lock type mechanism. Preferably, the second tubular section is provided with a gas outlet having a gas vent orifice defining the gas vent means. Thus, when pre-oxygenation of the patient has been completed, the second tubular section to which the oxygen supply system is connected can be disconnected from the first tubular section and removed.

Due to the provision of the aforesaid valve enabling selective gas flow communication between the oxygen supply system and the gas delivery means or between the oxygen/anesthesia gas supply system and the gas delivery means, the apparatus according to the invention permits pre-oxygenation of a patient and single breath induction anesthesia thereof, without causing pollution of the operating room with anesthesia gas.

The present invention therefore also provides, in another aspect thereof, a single breath induction anesthesia valve adapted to be used with gas delivery means for delivering at least one gas to a patient, with an oxygen supply system for providing oxygen and with an oxygen/anesthesia gas supply system for providing a gas mixture containing oxygen and at least one anesthesia gas at a preset optimum ratio sufficient to induce anesthesia of the patient with a single breath. The valve according to the invention comprises a valve body having a first port adapted to be in gas flow communication with the oxygen supply system, a second port adapted to be in gas flow communication with the oxygen/anesthesia gas supply system and a third port adapted to be in gas flow communication with the gas delivery means, and a valve member within the valve body. The valve

member is movable between a first position whereat the first port is in gas flow communication with the third and the second port is closed, whereby to permit delivery of oxygen to the patient and pre-oxygenation thereof, and a second position whereat the first port is closed and the second port is in gas flow communication with the third port, whereby to permit delivery of the oxygen/anesthesia gas mixture to the patient and single breath induction anesthesia thereof.

Brief Description of Drawings

Further features and advantages of the invention will become more readily apparent from the following description of preferred embodiments thereof as illustrated by way of examples in the accompanying drawings, in which:

Figure 1 schematically illustrates a single breath induction anesthesia apparatus according to a preferred embodiment of the invention;

Figure 2 is a partial top view of the apparatus illustrated in Fig. 1, showing the valve with the valve member thereof in a first position;

Figure 3 is another partial top view of the apparatus illustrated in Fig. 1, showing the valve with the valve member thereof in a second position;

Figure 4 is a partial side view of a single breath induction anesthesia apparatus according to another preferred embodiment of the invention, showing the valve with the valve member thereof in a first position;

Figure 5 is a view similar to Fig. 3, but showing the valve with the valve member thereof in a second position;

Figure 6 is an exploded perspective view of the valve illustrated in Fig. 4;

Figure 7 is an exploded perspective view of the valve illustrated in Fig. 5 and shown with a safety cap; and

Figure 8 is a perspective view of the valve illustrated in Fig. 7, showing the safety cap installed on the valve member.

Modes of Carrying the Invention

Referring first to Fig. 1, there is illustrated a single breath induction anesthesia apparatus which is generally designated by reference numeral 10 and seen to comprise a gas delivery system 12 for delivering at least one gas to a patient (not shown), an oxygen supply system 14, an oxygen/anesthesia gas supply system 16 and a valve 18 for providing selective gas flow communication between the oxygen supply system 14 and the gas delivery system 12 or between the oxygen/anesthesia gas supply system 16 and the gas delivery system 12. The gas delivery system 12 comprises a connector tube 20 defining an elbow and a face mask 22 connected thereto. The oxygen supply system 14 comprises an oxygen source 24 and an oxygen bag 26 defining an oxygen reservoir. The oxygen/anesthesia gas supply system 16, on the other hand, includes an oxygen/anesthesia gas source circuit 28 and a breathing circuit 30 in gas flow communication with one another.

The oxygen/anesthesia gas source circuit 28 comprises an oxygen source 32 for supplying oxygen which flows through line 34 provided with a valve 36 and a flow-meter (not shown), a nitrous oxide source 38 for supplying nitrous oxide which flows through line 40 provided with a valve 42 and a flow-meter (not shown), lines 34 and 40 merging into line 44, and a vaporizer 46 which is connected to line 44 and mixes the oxygen and nitrous oxide with an anesthesia gas such as sevoflurane at a preset optimum ratio sufficient to induce anesthesia of the patient with a single breath. The nitrous oxide is another anesthesia gas which increases the anesthesia effect of sevoflurane. The vaporizer is controlled so as to provide a mixture containing oxygen, nitrous oxide and sevoflurane in

which the sevoflurane is present in a concentration of about 8 vol. %. The breathing circuit 30 which is in gas flow communication with the oxygen/anesthesia gas source circuit 28 via line 48 comprises a Y-shaped conduit 50 and a carbon dioxide absorber 52 connected thereto, the Y-shaped conduit 50 comprising three conduit sections 54, 56 and 58. The conduit sections 56 and 58 are provided with one-way valves (not shown) so as to direct the flow of gases exhaled by the patient through expiratory conduit section 56 along the direction indicated by arrow 60 and through inspiratory conduit section 58 along the direction indicated by arrow 62. Thus, when the valve 18 is operated to establish gas flow communication between the oxygen/anesthesia gas supply system 16 and the gas delivery system 12, gases inhaled and exhaled by the patient pass through the gas delivery system 12 and the valve 18 and circulate through the breathing circuit 30. The carbon dioxide absorber 52 absorbs carbon dioxide from the gases exhaled by the patient, thereby allowing the oxygen/anesthesia gas mixture to be returned to the patient with less carbon dioxide.

As shown in Figs. 2 and 3, the valve 18 is a manually operated two-way valve comprising a generally T-shaped valve body 64 having three tubular branches 66, 68 and 70 with ports 72, 74 and 76 defined at the respective proximal ends of the tubular branches 66, 68 and 70, respectively, and a valve member 78 arranged within the valve body 64 at the intersection of the tubular branches 66, 68 and 70. The valve member 78 has a T-shaped gas passage 80 formed therein and is movable between a first position shown in Fig. 2, whereat the port 72 is in gas flow communication with the port 76 and the port 74 is closed, and a second position shown in Fig. 3, whereat the port 72 is closed and the port 74 is in gas flow communication with the port 76. A handle 82 is provided for manually moving the valve member 78 between these two positions. The valve body 64 has a cylindrical portion 84 provided with an arcuate cut-out 86 defining at the longitudinal ends thereof two abutment surfaces 88 (shown in Fig. 3) and 90 (shown in Fig. 2). The valve member 78, on the other hand, is provided with an arcuate stop member 92 extending into the cut-out 86 and having two abutment surfaces 94 (shown in Fig. 3) and 96 (shown in Fig. 2). The abutment surfaces 88 and 94 cooperate with one another to arrest the movement of the

valve member 78 at the first position, whereas the abutment surfaces 90 and 96 cooperate with one another to arrest the movement of the valve member 78 at the second position.

The tubular branch 66 has a gas inlet 98 connected by means of a conduit 100 to the oxygen source 24 shown in Fig. 1, for providing gas flow communication between the port 72 and the oxygen source 24. The tubular branch 66 is also connected at its distal end to the oxygen reservoir bag 26 for providing gas flow communication between the port 72 and the oxygen reservoir bag 26. The tubular branch 66 is also provided with a gas outlet 102 having a gas vent orifice 104 for venting excess oxygen, or venting gases exhaled by the patient when the valve member 78 is in the first position.

The tubular branch 68 is connected to the conduit section 54 of the Y-shaped conduit 50 for providing gas flow communication between the port 74 and the oxygen/anesthesia gas supply system 16. Such a tubular branch is provided with a gas outlet 106 having a gas discharge orifice 108 in gas flow communication with the port 74. The gas outlet 106 is connected by means of a conduit 110 to a gas analyzer 112 (shown in Fig. 1) for providing gas flow communication between the port 74 and the gas analyzer 112 to permit gas analysis of the oxygen/anesthesia gas mixture.

The tubular branch 70 is connected to the tube 20 for providing gas flow communication between the port 76 and the gas delivery system 12.

The tubular branches 66, 68 and 70 each have a circular cross-section with inner and outer diameters selected so that the tubular branch 66 can be fitted to any standard oxygen reservoir bag 26, the tubular branch 68 to any standard breathing circuit 30 and the tubular branch 70 to any standard gas delivery system 12.

In operation, the face mask 22 is affixed to the patient with the valve member 78 of the valve 18 being in the position shown in Fig. 2. In

this position of the valve member 78, the port 72 is in gas flow communication with the port 76 and the port 74 is closed. The oxygen source 24 is opened to allow oxygen to flow through the conduit 100, the gas inlet 98, the valve 18 along the direction indicated by arrow 114 and the gas delivery system 12, the oxygen also filling the reservoir bag 26. This permits a pre-oxygenation of the patient. The oxygen reservoir bag 26 enables the patient to inhale a larger volume of oxygen. At the same time, valves 36 and 42 are opened to allow oxygen and nitrous oxide to flow via lines 34,40,44 from the oxygen and nitrous oxide sources 32,38 to the vaporizer 46 where the oxygen and nitrous oxide are mixed with the sevoflurane contained in the vaporizer 46, the resulting gas mixture flowing from the vaporizer 46 to the breathing circuit 30 via line 48. When the sevoflurane has reached the desired concentration indicated by the gas analyzer 112, the valve member 78 of the valve 18 is moved to the position shown in Fig. 3. In this position of the valve member 78, the port 72 is closed and the port 74 is in gas flow communication with the port 76. The oxygen/anesthesia gas mixture thus flows from the oxygen/anesthesia gas supply system 16 through the valve 18 along the direction indicated by arrow 116 and the gas delivery system 12. This permits single breath induction anesthesia of the patient. Excess oxygen is vented through the gas vent orifice 104. Valves 36 and 42 can then be partially closed to reduce the flow of oxygen and nitrous oxide.

Instead of using sevoflurane, it is possible to use any other type of anesthesia gas available on the market. The optimum concentration of anesthesia gas sufficient to cause anesthesia of a patient with a single breath may of course vary depending on the patient and the type of anesthesia gas used. The use of nitrous oxide is also optional.

Although a breathing circuit 30 of recirculatory type has been illustrated, it is possible to use other types of breathing circuits or systems, such as Mapleson systems, including Bain and Ayers T systems.

The apparatus illustrated in Figs. 4 and 5 is similar to the apparatus shown in Figs. 1-3, with the exception that the apparatus of Figs. 4

and 5 comprises a valve 118 of different construction. As best shown in Figs. 6 and 7, the valve 118 is a manually operated two-way valve comprising a generally T-shaped valve body 120 having a hollow cylindrical portion 122 and three tubular branches 124, 126 and 128 with ports 130, 132 and 134 defined at the respective proximal ends of the tubular branches 124, 126 and 128, and a valve member 136 arranged in the cylindrical portion 122 of the valve body 120. The tubular branches 124 and 126 extend along a common axis 138, whereas the tubular branch 128 extend along a longitudinal axis 140 which is disposed at right angle relative to the axis 138. The valve member 136 has a tubular portion 142 of cylindrical cross-section defining an inner gas chamber 144 in gas flow communication with the port 134, and a top portion 146 disposed over the tubular portion 142, the top portion 146 being provided with a handle 148. The tubular portion 142 has an aperture 150 formed therein. The cyclindrical portion 122 of the valve body 120 receives the tubular portion 142 of the valve member 136.

The valve member 136 is removably mounted in the cylindrical portion 122 of the valve body 120 by means of a rib 152 extending about the outer periphery of the tubular portion 142 of the valve member 136 and engaging a circumferential groove 154 formed in the inner surface of the cylindrical portion 122. The valve member 136 is also rotatably mounted in the latter for movement about a rotation axis coaxial with the axis 140, between a first position shown in Figs. 4 and 6, whereat the gas chamber 144 is in gas flow communication via the aperture 150 with the port 130 and the port 132 is closed, and a second position shown in Figs. 5 and 7, whereat the gas chamber 144 is in gas flow communication via the aperture 150 with the port 132 and the port 130 is closed. Thus, when the valve member 136 is in the first position, the port 130 is in gas flow communication with the port 134 and, when the valve member 136 is in the second position, the port 132 is in gas flow communication with the port 134. The handle 148 enables one to manually move the valve member 136 between these two positions.

In order to arrest the movement of the valve member 136 at each of the above two positions, the cylindrical portion 122 of the valve

body 120 has at an end thereof a radially enlarged section 156 defining an arcuate channel 158 with two abutment surfaces 160 and 162 (shown in Fig. 7) at longitudinal ends of the channel 158. The tubular portion 142 of the valve member 136, on the other hand, is provided with a stop member 164 extending into the channel 158 and having two abutment surfaces 166 and 168. The abutment surfaces 160 and 166 cooperate with one another to arrest the movement of the valve member 136 at the first position, whereas the abutment surfaces 162 and 168 cooperate with one another to arrest the movement of the valve member 136 at the second position. The section 156 is provided with two small, inwardly extending projections 170 and 172 over which the stop member 164 passes when the valve member 136 is moved to the first or second position so that the abutment surface 166 or 168 engages the abutment surface 160 or 172 in a snaping action.

The tubular branch 124 comprises a tubular section 124A which is fixed to the cylindrical portion 122 of the valve body 120 and a tubular section 124B which is removably connected to the tubular section 124A by means of a bayonet-lock type mechanism. Such a mechanism comprises a lock pin 174 extending outwardly from the tubular section 124A at the distal end thereof and a L-shaped slot 176 formed in the tubular section 124B at one end thereof and receiving the lock pin 174 in releasable locking engagement. The L-shaped slot 176 has a slot portion 178 extending longitudinally of the tubular section 124B and a slot portion 180 extending at right angle relative to the slot portion 178. When the tubular sections 124A and 124B are connected together, the lock pin 174 is disposed in the slot portion 180 in the lock position shown in Fig. 8. The tubular section 124B is provided at the ends thereof with two collars 182 and 184 which are integrally formed therewith, the collar 182 partially covering the slot portion 178.

The tubular section 124B has a gas inlet 186 connected by means of the conduit 100 to the oxygen source 24 shown in Fig. 1, for providing gas flow communication between the port 130 and the oxygen source 24. Since the slot portion 180 of the L-shaped slot 176 extends in a direction opposite to the direction in which the gas outlet extends, the weight

of the gas outlet and conduit 100 biases the lock pin 174 in the slot portion 180 to the lock position shown in Fig. 8. The tubular section 124B is also connected at its distal end to an oxygen reservoir bag 26' for providing gas flow communication between the port 130 and the oxygen reservoir bag 26'. The bag 26' which also serves as an oxygen breathing bag has a tubular portion 188 provided with inner and outer sleeves 190 and 192 made of a resilient material such as rubber. The sleeve 190 is disposed about the collar 184 in gas-tight engagement therewith. The tubular section 124B is provided with a gas outlet 194 having a gas vent orifice 196 (shown in Figs. 6-8) for venting excess oxygen, or venting gases exhaled by the patient when the valve member 136 is in the first position.

The tubular branch 126 is connected to the conduit section 54' of a Y-shaped conduit 50' which is similar to the Y-shaped conduit 50 shown in Fig. 1, for providing gas flow communication between the port 132 and the oxygen/anesthesia gas supply system 16 (shown in Fig. 1). The conduit sections 56' and 58' of the Y-shaped conduit 50' are connected to the carbon dioxide absorber 52. As in the case of conduit sections 56 and 58, the conduit sections 56' and 58' are provided with one-way valves (not shown) so as to direct the flow of gases exhaled by the patient through expiratory conduit section 56' along the direction indicated by the arrow 60 (shown in Fig. 1) and through inspiratory conduit section 58' along the direction indicated by the arrow 62 (also shown in Fig. 1). The tubular branch 126 is provided with a gas outlet 194 having a gas discharged orifice 196 in gas flow communication with the port 132. The gas outlet 194 is connected by means of a conduit 110' which is similar to the conduit 110 shown in Fig. 1 to the gas analyzer 112 (shown in Fig. 1), for providing gas flow communication between the port 132 and the gas analyzer 112 to permit gas analysis of the oxygen/anesthesia gas mixture. The conduit 110' extends through a cap 198 which is removably connected to the gas outlet 194 by means of a Luer-lock type coupling system 200.

The tubular branch 128 is connected directly to a face mask 22' for providing gas flow communication between the port 134 and the face

mask 22'. The mask 22' has a frusto-conical portion 202 provided with a cushioned flange 204.

The apparatus shown in Figs. 4 and 5 is operated in essentially the same manner as the apparatus shown in Fig. 1. During pre-oxygenation of the patient, the valve member 136 of the valve 118 is in the position shown in Figs. 4 and 6. In this position of the valve member 136, the port 130 is in gas flow communication with the port 134 and the port 132 is closed. Thus, oxygen flows from the oxygen source (shown in Fig. 1) through the conduit 100, the gas inlet 186, the valve 118 along the direction indicated by arrow 206 and the face mask 22', the oxygen also filling the reservoir bag 26'. After pre-oxygenation has been effected, the valve member 136 of the valve 118 is moved to the position shown in Figs. 5 and 7, and the tubular section 124B is disconneted from the tubular section 124A and removed. In this position of the valve member 136, the port 130 is closed and the port 132 is in gas flow communication with the port 134. Thus, the oxygen/anesthesia gas mixture flows from the oxygen/anesthesia gas supply system 16 (shown in Fig. 1) through the valve 118 along the direction indicated by arrow 208 and the face mask 22', causing single breath induction anesthesia of the patient. The handle 148 is in the form of an arrow indicating the direction of gas flow. Since during movement of the valve member 136 from the position shown in Figs. 4 and 6 to the position shown in Figs. 5 and 7, the valve member 136 moves about a rotation axis which is coaxial with the longitudinal axis 140 of the tubular branch 128, the pressure exerted on the valve member 136 to rotate same contributes to providing a gas-tight seal between the cushioned flange 204 of the mask 22' and the patient's face.

In order to releasably lock the valve member 136 in the position shown in Figs. 5 and 7, after a ventilation and endotracheal intubation has been performed, use is made of a safety cap 210 shown in Figs. 7 and 8. The safety cap 210 comprises a dome-shaped skirt 212, a hollow handle 214 extending outwardly from the skirt 212 and an arcuate locking lip 216 depending from the skirt 212. The safety cap 210 is adapted to removably fit over the top portion 146 and handle 148 of the valve

member 136 with the locking lip 216 extending into the channel 158 to prevent displacement of the stop member 164 when the valve member 136 is in the position shown in Figs. 5 and 7. Fig. 8 shows the safety cap 210 installed over the valve member 136 and releasably locking same. In order to prevent the locking lip 216 from having access to the channel 158 when the valve member is in the position shown in Figs. 4 and 6, the valve member 136 is provided with an arcuate flange 218 extending radially outwardly from the tubular portion 142 of the valve member 136 and disposed adjacent the top portion 146 thereof. The flange 218 extends over the channel 158 when the valve member is in the position shown in Figs. 4 and 6 and thus acts as a shield preventing the locking lip 216 from being inserted into the channel 158.

CLAIMS

1. A single breath induction anesthesia apparatus for anesthetising a patient, comprising:

- gas delivery means for delivering at least one gas to the patient;

- an oxygen supply system for providing oxygen;

- an oxygen/anesthesia gas supply system for mixing oxygen and at least one anesthesia gas at a preset optimum ratio sufficient to induce anesthesia of the patient with a single breath, thereby providing an oxygen/anesthesia gas mixture; and

- a valve for providing selective gas flow communication between said oxygen supply system and said gas delivery means or between said oxygen/anesthesia gas supply system and said gas delivery means, said valve being operable for first establishing gas flow communication between said oxygen supply system and said gas delivery means to deliver oxygen to the patient and permit pre-oxygenation thereof, while inhibiting gas flow communication between said oxygen/anesthesia gas supply system and said gas delivery means to allow the oxygen/anesthesia gas mixture to reach said preset optimum ratio, and thereafter establishing gas flow communication between said oxygen/anesthesia gas supply system and said gas delivery means to deliver said oxygen/anesthesia gas mixture to the patient and permit single breath induction anesthesia thereof, while inhibiting gas flow communication between said oxygen supply system and said gas delivery means.

2. An apparatus according to claim 1, wherein said valve comprises a valve body having a first port in gas flow communication with said oxygen supply system, a second port in gas flow communication with said oxygen/anesthesia gas supply system and a third port in gas flow communication with said gas delivery means, and a valve member within

said valve body, and wherein said valve member is movable between a first position whereat said first port is in gas flow communication with said third port and said second port is closed, and a second position whereat said first port is closed and said second port is in gas flow communication with said third port.

3. An apparatus according to claim 2, wherein said valve includes stop means for arresting the movement of said valve member at each of said first and second positions.

4. An apparatus according to claim 3, wherein said stop means each comprise cooperating abutment means disposed on said valve member and said valve body.

5. An apparatus according to claim 3, wherein said valve member is provided with a handle for manually moving said valve member between said first and second positions.

6. An apparatus according to claim 2, wherein said oxygen/anesthesia gas supply system includes a breathing circuit for collecting and recirculating gases exhaled by the patient, whereby when said valve member is in said second position gases inhaled and exhaled by said patient pass through said gas delivery system and said valve and circulate through said breathing circuit.

7. An apparatus according to claim 6, wherein said breathing circuit is provided with a carbon dioxide absorber for absorbing carbon dioxide from the gases exhaled by the patient, thereby allowing said oxygen/anesthesia gas mixture to be returned to said patient with less carbon dioxide.

8. An apparatus according to claim 2, wherein said valve body has first, second and third tubular branches, and wherein said first, second and third ports are defined at respective proximal ends of said first, second and third tubular branches, respectively.

9. An apparatus according to claim 8, wherein said second and third ports are disposed along a first axis and said first port is disposed along a second axis extending transversely of said first axis, and wherein said second and third tubular branches extend along said first axis and said first tubular branch extends along said second axis.

10. An apparatus according to claim 9, wherein said valve member has a generally T-shaped gas passage formed therein.

11. An apparatus according to claim 8, wherein said oxygen supply system includes an oxygen source and wherein said first tubular branch has a gas inlet connected to said oxygen source for providing gas flow communication between said first port and said oxygen source.

12. An apparatus according to claim 11, wherein said oxygen supply system further includes an oxygen reservoir and wherein said first tubular branch is connected to said oxygen reservoir for providing gas flow communication between said first port and said oxygen reservoir.

13. An apparatus according to claim 12, wherein said gas inlet is disposed between the proximal end of said first tubular branch and a distal end thereof, and wherein said oxygen reservoir is connected to the distal end of said first tubular branch.

14. An apparatus according to claim 8, wherein said first tubular branch is provided with gas vent means for venting excess oxygen, or venting gases exhaled by the patient when said valve member is in said first position.

15. An apparatus according to claim 14, wherein said first tubular branch is provided with a gas outlet having a gas vent orifice defining said gas vent means.

16. An apparatus according to claim 8, wherein said second tubular branch has a gas outlet connected to a gas analyzer for providing gas flow communication between said second port and said gas analyzer to permit gas analysis of said oxygen/anesthesia gas mixture.

17. An apparatus according to claim 8, wherein said first and second ports are disposed along a first axis and said third port is disposed along a second axis extending transversely of said first axis, and wherein said first and second tubular branches extend along said first axis and said third tubular branch extends along said second axis.

18. An apparatus according to claim 17, wherein said oxygen supply system includes an oxygen source and wherein said first tubular branch has a gas inlet connected to said oxygen source for providing gas flow communication between said first port and said oxygen source.

19. An apparatus according to claim 18, wherein said oxygen supply system further includes an oxygen reservoir and wherein said first tubular branch is connected to said oxygen reservoir for providing gas flow communication between said first port and said oxygen reservoir.

20. An apparatus according to claim 19, wherein said gas inlet is disposed between the proximal end of said first tubular branch and a distal end thereof, and wherein said oxygen reservoir is connected to the distal end of said first tubular branch.

21. An apparatus according to claim 20, wherein said first tubular branch comprises a first tubular section and a second tubular section removably connected at one end thereof to said first tubular section, and wherein said second tubular section is provided with said gas inlet and has an end opposite said one end defining said distal end of said first tubular branch.

22. An apparatus according to claim 21, wherein said second tubular section is removably connected to said first tubular section by means of a bayonet-lock type mechanism.

23. An apparatus according to claim 22, wherein said bayonet-lock type mechanism comprises a lock pin extending outwardly from said first tubular section at a distal end thereof and a L-shaped slot formed in said second tubular section at said one end thereof and receiving said lock pin in releasable locking engagement.

24. An apparatus according to claim 23, wherein said gas inlet extends outwardly from said second tubular section in a first direction, and wherein said L-shaped slot has a first slot portion extending longitudinally of said second tubular section and a second slot portion extending transversely of said first slot portion in second direction opposite to said first direction, whereby said lock pin is biased to a lock position in said second slot portion.

25. An apparatus according to claim 21, wherein said second tubular section is provided with gas vent means for venting excess oxygen, or venting gases exhaled by the patient when said valve member is in said first position.

26. An apparatus according to claim 25, wherein said second tubular section is provided with a gas outlet having a gas vent orifice defining said gas vent means.

27. An apparatus according to claim 17, wherein said second tubular branch has a gas outlet connected to a gas analyzer for providing gas flow communication between said second port and said gas analyzer to permit gas analysis of said oxygen/anesthesia gas mixture.

28. An apparatus according to claim 17, wherein said valve member is rotatably mounted in said valve body for movement about a rotation axis co-axial with said second axis.

29. An apparatus according to claim 28, wherein said valve member is removably mounted in said valve body.

30. An apparatus according to claim 28, wherein said valve member has a tubular portion of cylindrical cross-section defining an inner gas chamber in gas flow communication with said third port, said tubular portion having an aperture formed therein and providing gas flow communication between said gas chamber and said first port when said valve member is in said first position, and gas flow communication between said gas chamber and said second port when said valve member is in said second position, and wherein said valve body has a cylindrical portion receiving the tubular portion of said valve member.

31. An apparatus according to claim 30, wherein said valve includes stop means for arresting the movement of said valve member at each of said first and second positions.

32. An apparatus according to claim 31, wherein said valve member is provided with a handle for manually moving said valve member between said first and second positions.

33. An apparatus according to claim 31, wherein said stop means each comprise cooperating abutment means disposed on the tubular portion of said valve member and on the cylindrical portion of said valve body.

34. An apparatus according to claim 33, wherein the cylindrical portion of said valve body has at an end thereof a radially enlarged section defining an arcuate channel with first and second abutment surfaces at longitudinal ends of said channel, and wherein the tubular portion of said valve member is provided with a stop member extending into said channel and being displaceable therein upon movement of valve member, said stop member having third and fourth abutment surfaces cooperating respectively with said first and second abutment surfaces to arrest the movement of said

valve member at each of said first and second positions, said first, second, third and fourth abutment surfaces defining said abutment means.

35. An apparatus according to claim 34, wherein said valve includes safety means for releasably locking said valve member in said second position.

36. An apparatus according to claim 35, wherein said valve member has a top portion disposed over said tubular portion, and wherein said safety means comprise a safety cap having an arcuate locking lip and adapted to removably fit over the top portion of said valve member with said locking lip extending into said channel to prevent displacement of said stop member when said valve member is in said second position.

37. An apparatus according to claim 36, wherein said valve member is provided with shield means for preventing said locking lip from having access to said channel when said valve member is in said first position.

38. An apparatus according to claim 37, wherein said shield means comprise an arcuate flange extending radially outwardly from the tubular portion of said valve member and disposed adjacent the top portion thereof, said flange extending over said channel when said valve member is in said first position.

39. An apparatus according to claim 1, wherein said anesthesia gas is sevoflurane.

40. An apparatus according to claim 39, wherein said oxygen/anesthesia gas mixture at said preset optimum ratio contains sevoflurane in a concentration of about 8 vol.%.

41. An apparatus according to claim 1, wherein said oxygen/anesthesia gas supply system comprises a source of oxygen, a source of sevoflurane and a source of nitrous oxide, and is adapted to

provide a mixture containing oxygen, sevoflurane and nitrous oxide in which sevoflurane is present in a concentration of about 8 vol. %.

42. A single breath induction anesthesia valve adapted to be used with gas delivery means for delivering at least one gas to a patient, with an oxygen supply system for providing oxygen and with an oxygen-anesthesia gas supply system for providing a gas mixture containing oxygen and at least one anesthesia gas at a preset optimum ratio sufficient to induce anesthesia of the patient with a single breath, said valve comprising a valve body having a first port adapted to be in gas flow communication with said oxygen supply system, a second port adapted to be in gas flow communication with said oxygen/anesthesia gas supply system and a third port adapted to be in gas flow communication with said gas delivery means, and a valve member within said valve body, said valve member being movable between a first position whereat said first port is in gas flow communication with said third port and said second port is closed, whereby to permit delivry of oxygen to the patient and pre-oxygenation thereof, and a second position whereat said first port is closed and said second port is in gas flow communication with said third port, whereby to permit delivery of the oxygen/anesthesia gas mixture to the patient and single breath induction anesthesia thereof.

43. A valve according to claim 42, further including stop means for arresting the movement of said valve member at each of said first and second positions.

44. A valve according to claim 43, wherein said stop means each comprise cooperating abutment means disposed on said valve member and said valve body.

45. A valve according to claim 43, wherein said valve member is provided with a handle for manually moving said valve member between said first and second positions.

46. A valve according to claim 42, wherein said valve body has first, second and third tubular branches, and wherein said first, second and third ports are defined at respective proximal ends of said first, second and third tubular branches, respectively.

47. A valve according to claim 46, wherein said second and third ports are disposed along a first axis and said first port is disposed along a second axis extending transversely of said first axis, and wherein said second and third tubular branches extend along said first axis and said first tubular branch extends along said second axis.

48. A valve according to claim 47, wherein said valve member has a generally T-shaped gas passage formed therein.

49. A valve according to claim 46, wherein said first tubular branch has a gas inlet adapted to be connected to an oxygen source of said oxygen supply system for providing gas flow communication between said first port and said oxygen source.

50. A valve according to claim 49, wherein said first tubular branch is adapted to be connected to an oxygen reservoir of the oxygen supply system for providing gas flow communication between said first port and said oxygen reservoir.

51. A valve according to claim 49, wherein said gas inlet is disposed between the proximal end of said first tubular branch and a distal end thereof, and wherein said first tubular branch is adapted to be connected at the distal end thereof to an oxygen reservoir of the oxygen supply system for providing gas flow communication between said first port and the oxygen reservoir.

52. A valve according to claim 46, wherein said first tubular branch is provided with gas vent means for venting excess oxygen, or venting gases exhaled by the patient when said valve member is in said first position.

53. A valve according to claim 52, wherein said first tubular branch is provided with a gas outlet having a gas vent orifice defining said gas vent means.

54. A valve according to claim 46, wherein said second tubular branch has a gas outlet adapted to be connected to a gas analyzer for providing gas flow communication between said second port and said gas analyzer to permit gas analysis of said oxygen/anesthesia gas mixture.

55. A valve according to claim 46, wherein said first and second ports are disposed along a first axis and said third port is disposed along a second axis extending transversely of said first axis, and wherein said first and second tubular branches extend along said first axis and said third tubular branch extends along said second axis.

56. A valve according to claim 55, wherein said first tubular branch has a gas inlet adapted to be connected to an oxygen source of said oxygen supply system for providing gas flow communication between said first port and said oxygen source.

57. A valve according to claim 56, wherein said first tubular branch is adapted to be connected to an oxygen reservoir of the oxygen supply system for providing gas flow communication between said first port and said oxygen reservoir.

58. A valve according to claim 56, wherein said gas inlet is disposed between the proximal end of said first tubular branch and a distal end thereof, and wherein said first tubular branch is adapted to be connected at the distal end thereof to an oxygen reservoir of the oxygen supply system for providing gas flow communication between said first port and the oxygen reservoir.

59. A valve according to claim 58, wherein said first tubular branch comprises a first tubular section and a second tubular section

removably connected at one end thereof to said first tubular section, and wherein said second tubular section is provided with said gas inlet and has an end opposite said one end defining said distal end of said first tubular branch.

60. A valve according to claim 59, wherein said second tubular section is removably connected to said first tubular section by means of a bayonet-lock type mechanism.

61. A valve according to claim 60, wherein said bayonet-lock type mechanism comprises a lock pin extending outwardly from said first tubular section at a distal end thereof and a L-shaped slot formed in said second tubular section at said one end thereof and receiving said lock pin in releasable locking engagement.

62. A valve according to claim 61, wherein said gas inlet extends outwardly from said second tubular section in a first direction, and wherein said L-shaped slot has a first slot portion extending longitudinally of said second tubular section and a second slot portion extending transversely of said first slot portion in second direction opposite to said first direction, whereby said lock pin is biased to a lock position in said second slot portion.

63. A valve according to claim 59, wherein said second tubular section is provided with gas vent means for venting excess oxygen, or venting gases exhaled by the patient when said valve member is in said first position.

64. A valve according to claim 63, wherein said second tubular section is provided with a gas outlet having a gas vent orifice defining said gas vent means.

65. A valve according to claim 55, wherein said second tubular branch has a gas outlet connected to a gas analyzer for providing gas flow

communication between said second port and said gas analyzer to permit gas analysis of said oxygen/anesthesia gas mixture.

66. A valve according to claim 55, wherein said valve member is rotatably mounted in said valve body for movement about a rotation axis coaxial with said second axis.

67. A valve according to claim 66, wherein said valve member is removably mounted in said valve body.

68. A valve according to claim 66, wherein said valve member has a tubular portion of cylindrical cross-section defining an inner gas chamber in gas flow communication with said third port, said tubular portion having an aperture formed therein and providing gas flow communication between said gas chamber and said first port when said valve member is in said first position, and gas flow communication between said gas chamber and said second port when said valve member is in said second position, and wherein said valve body has a cylindrical portion receiving the tubular portion of said valve member.

69. A valve according to claim 68, further including stop means for arresting the movement of said valve member at each of said first and second positions.

70. A valve according to claim 69, wherein said valve member is provided with a handle for manually moving said valve member between said first and second positions.

71. A valve according to claim 69, wherein said stop means each comprise cooperating abutment means disposed on the tubular portion of said valve member and on the cylindrical portion of said valve body.

72. A valve according to claim 71, wherein the cylindrical portion of said valve body has at an end thereof a radially enlarged section defining an arcuate channel with first and second abutment surfaces at longitudinal

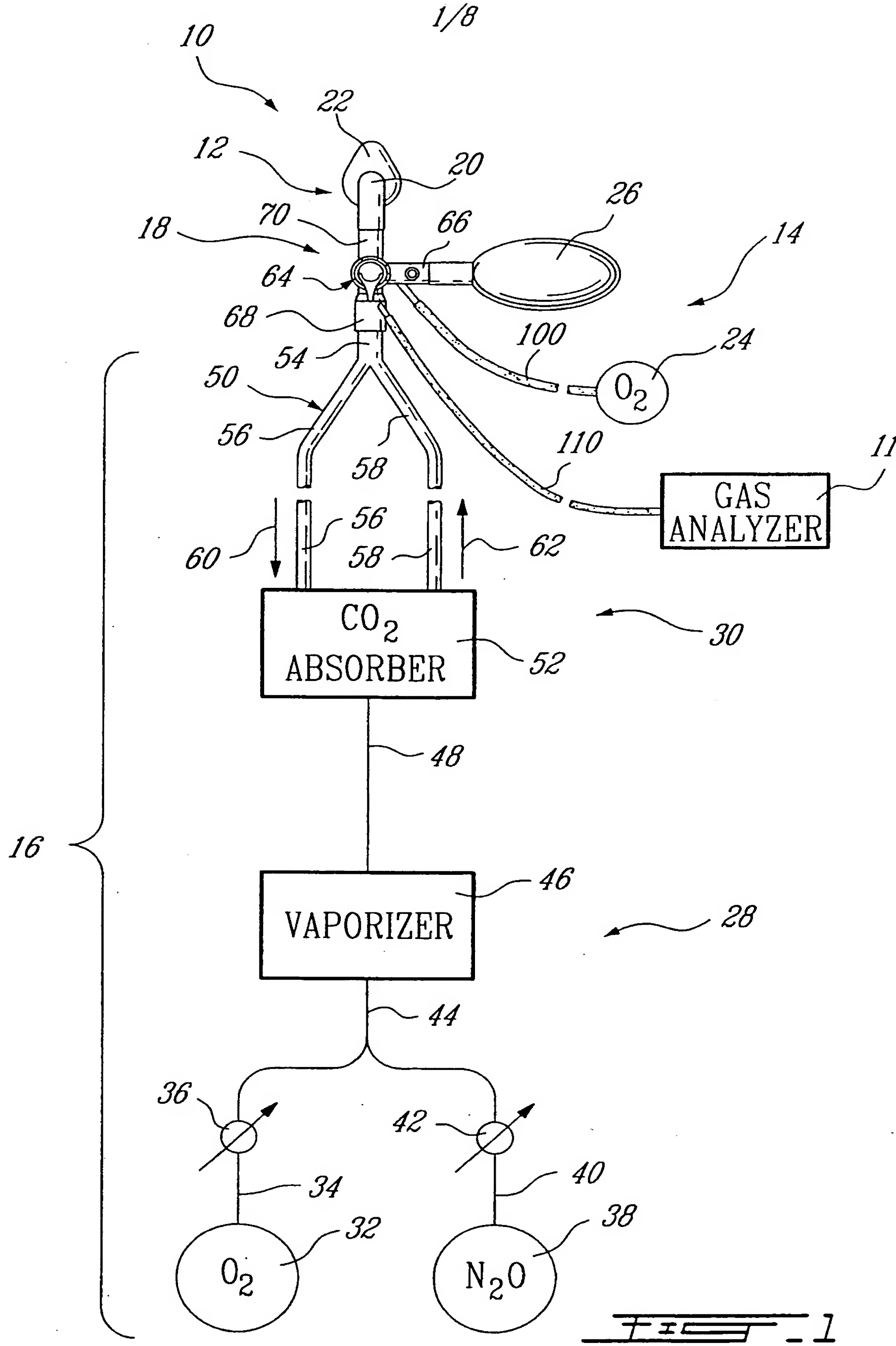
ends of said channel, and wherein the tubular portion of said valve member is provided with a stop member extending into said channel and being displaceable therein upon movement of valve member, said stop member having third and fourth abutment surfaces cooperating respectively with said first and second abutment surfaces to arrest the movement of said valve member at each of said first and second positions, said first, second, third and fourth abutment surfaces defining said abutment means.

73. A valve according to claim 72, wherein said valve includes safety means for releasably locking said valve member in said second position.

74. A valve according to claim 73, wherein said valve member has a top portion disposed over said tubular portion, and wherein said safety means comprise a safety cap having an arcuate locking lip and adapted to removably fit over the top portion of said valve member with said locking lip extending into said channel to prevent displacement of said stop member when said valve member is in said second position.

75. A valve according to claim 74, wherein said valve member is provided with shield means for preventing said locking lip from having access to said channel when said valve member is in said first position.

76. A valve according to claim 75, wherein said shield means comprise an arcuate flange extending radially outwardly from the tubular portion of said valve member and disposed adjacent the top portion thereof, said flange extending over said channel when said valve member is in said first position.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CO_2 ABSORBER
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O_2
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FIG. 1

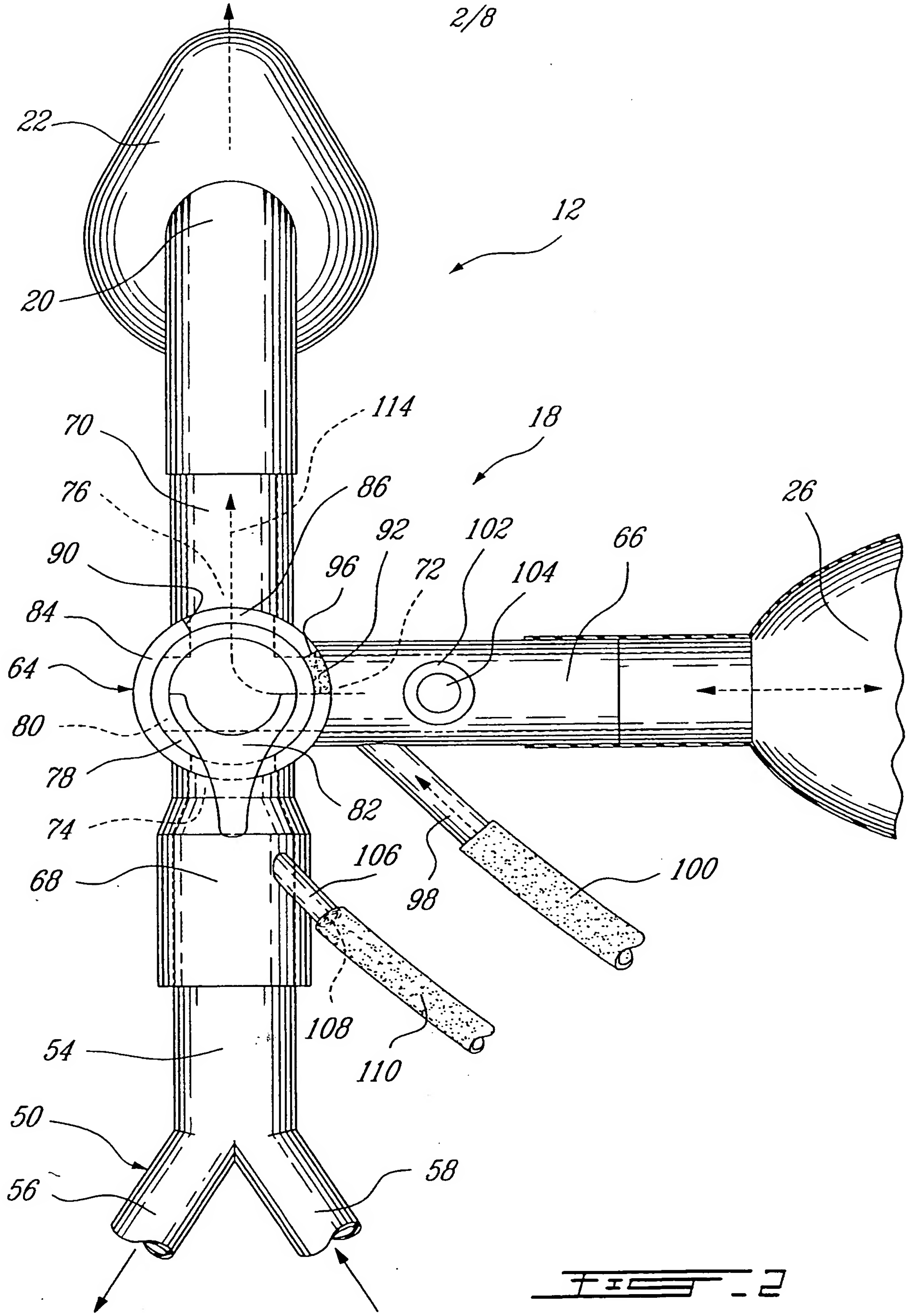
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FIG. 2

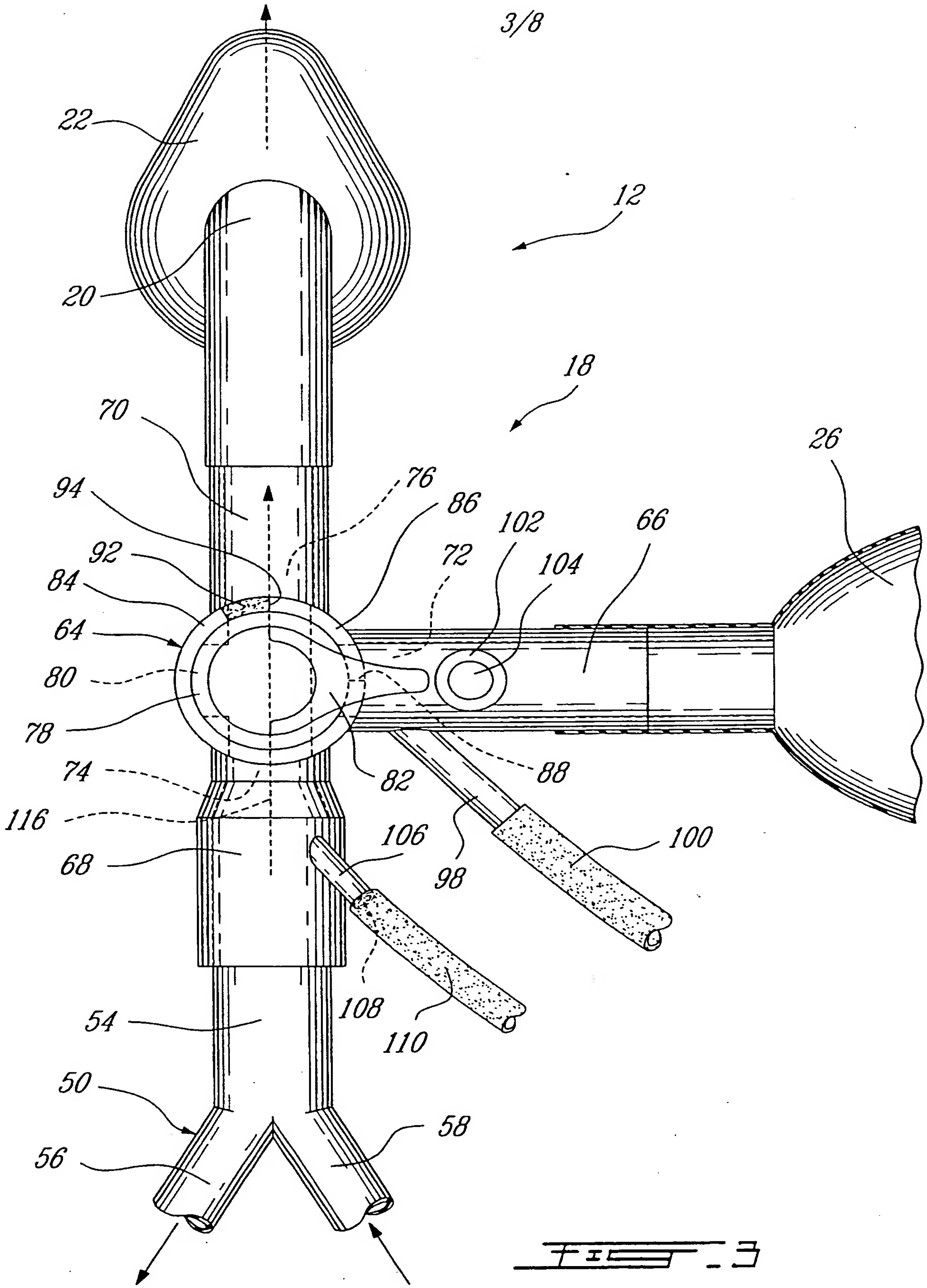
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FIG. 3

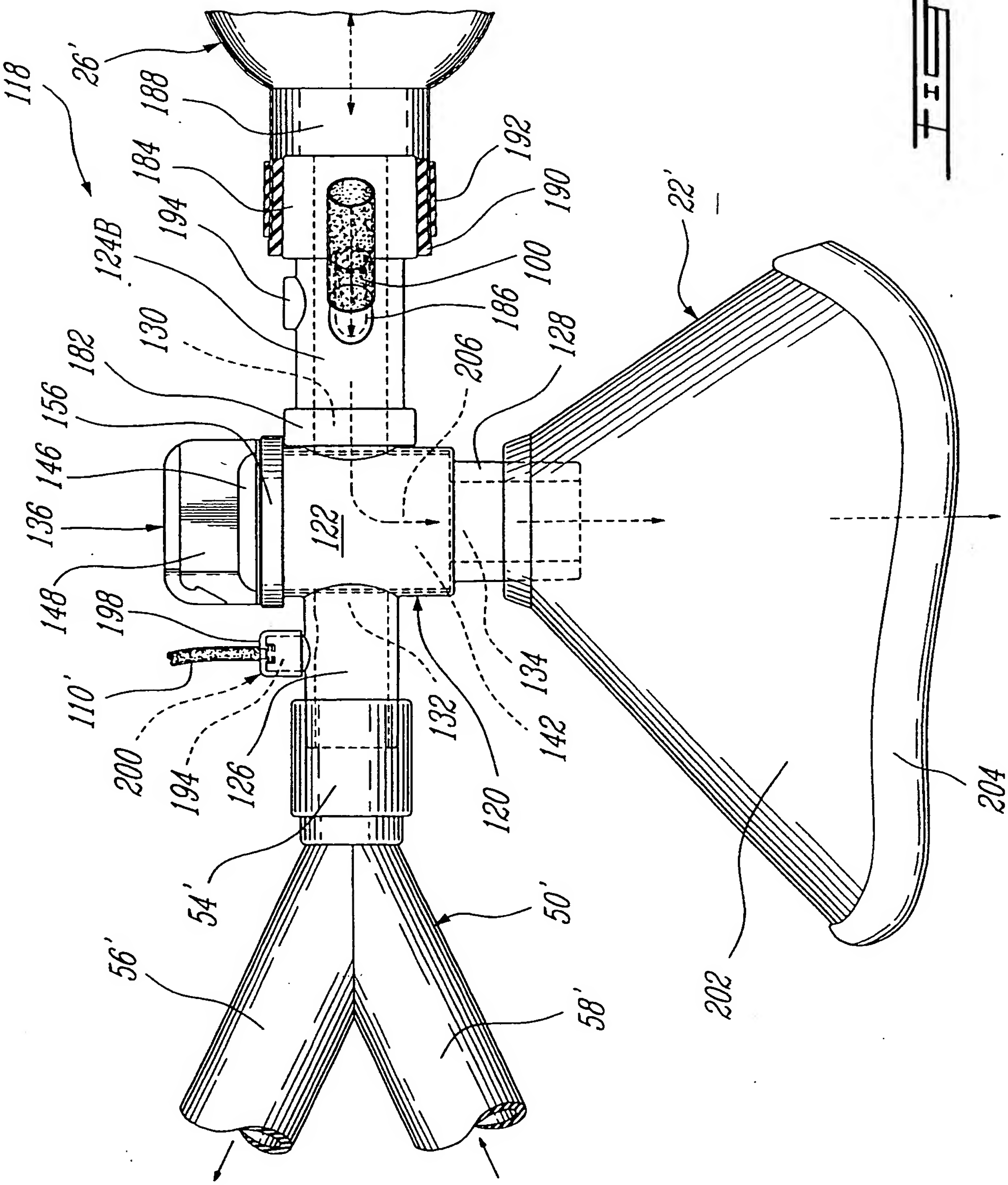
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FIG-4

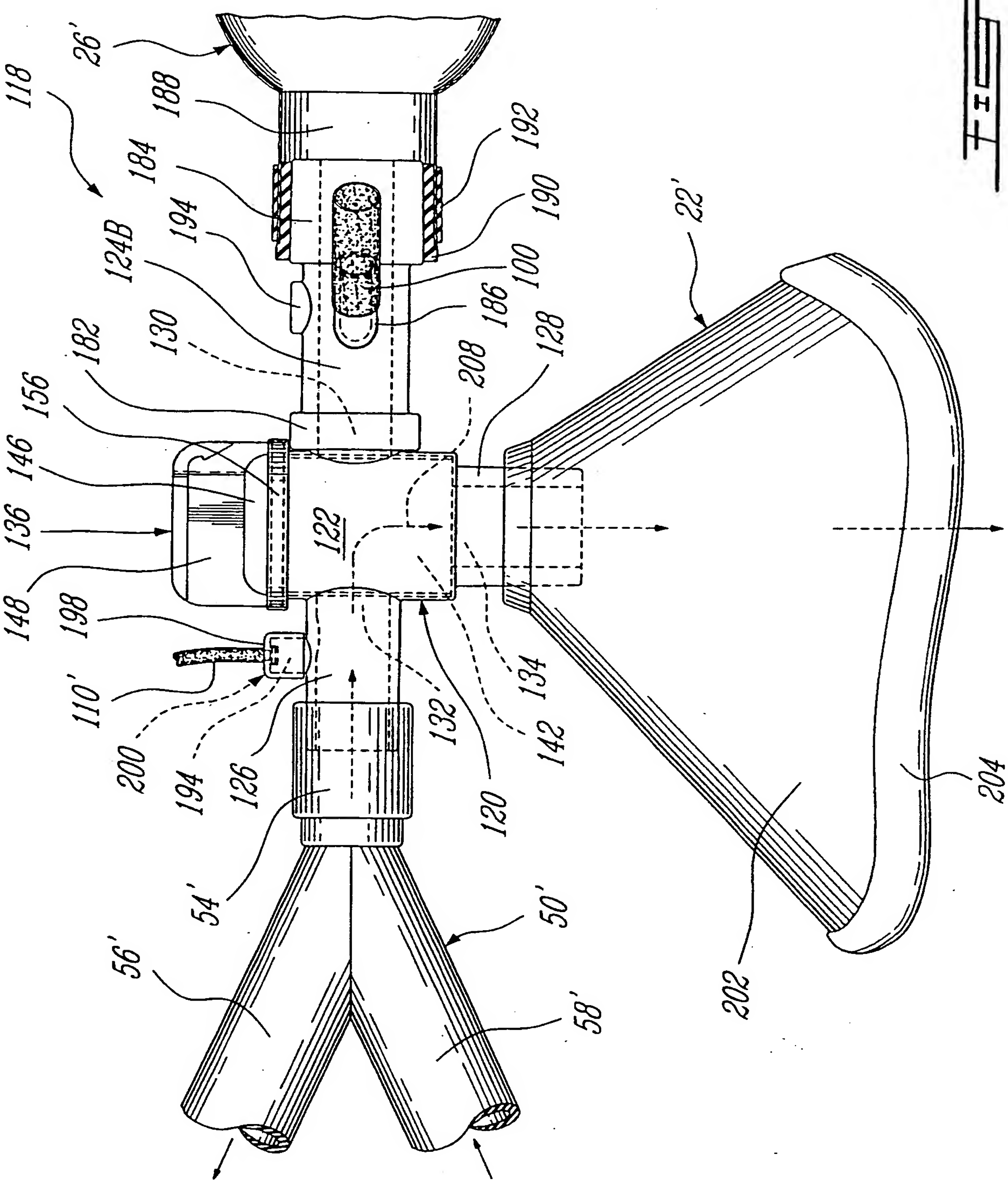
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FIG - 5

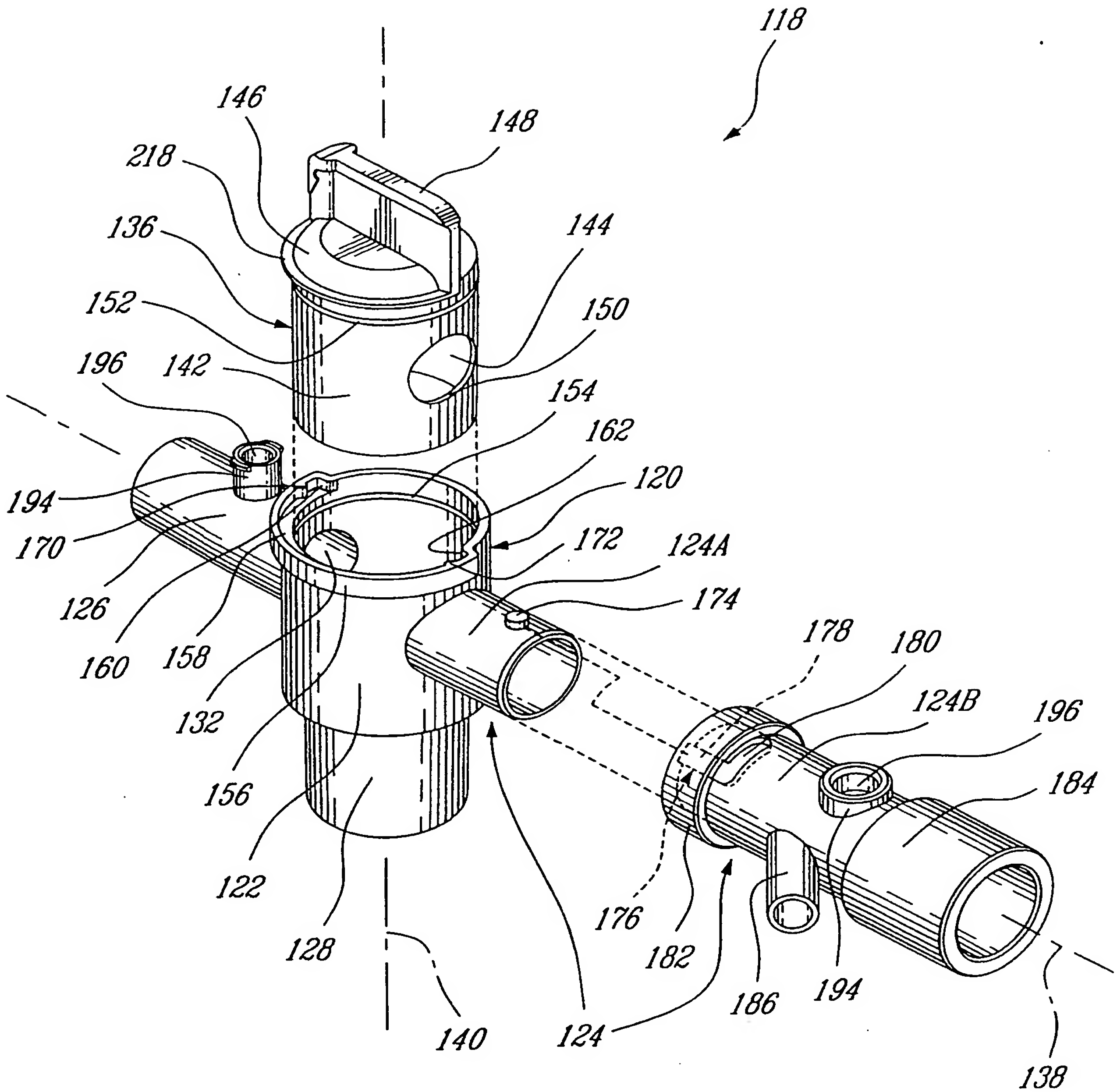
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FIG. 6

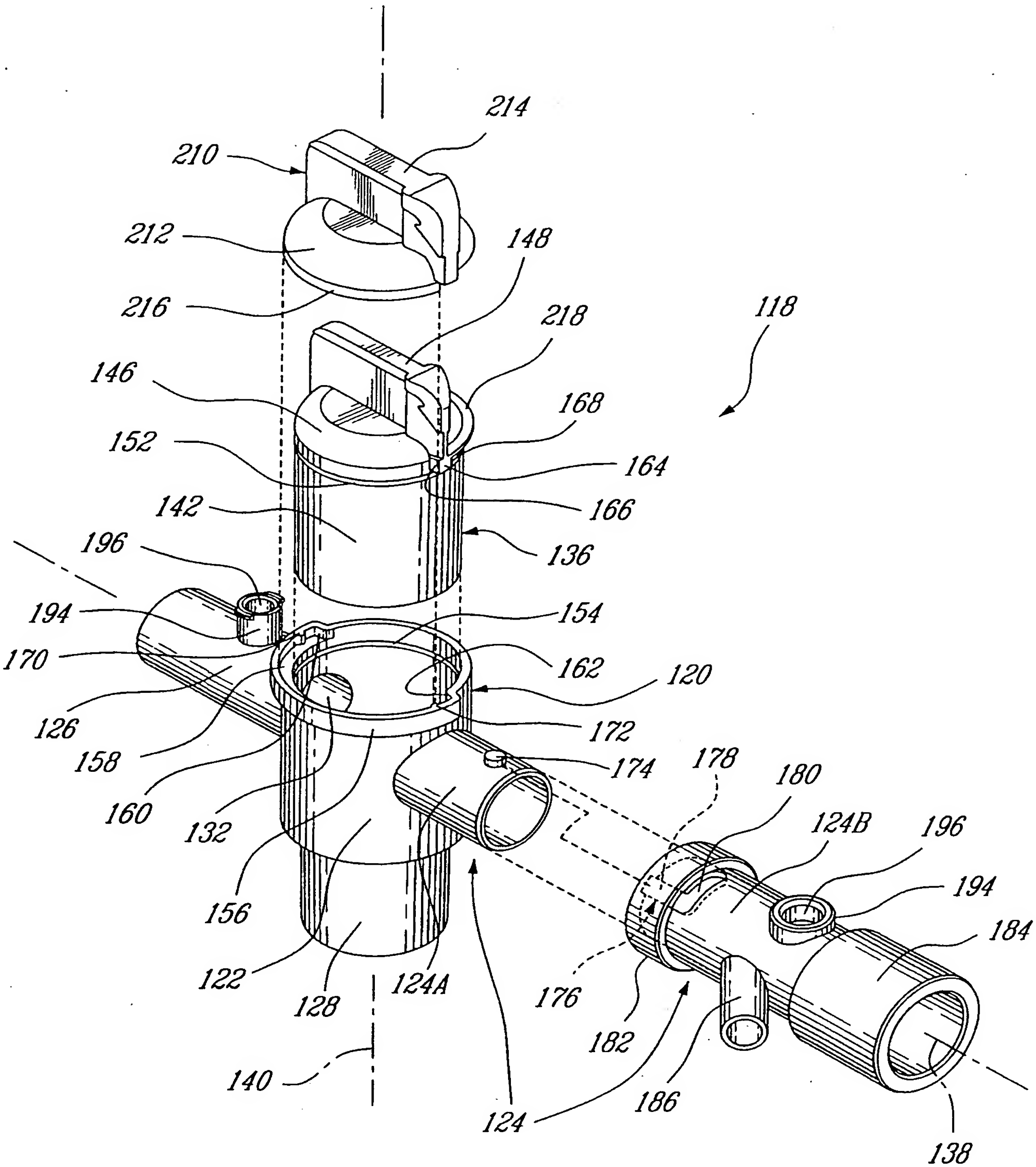
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FIG. 7

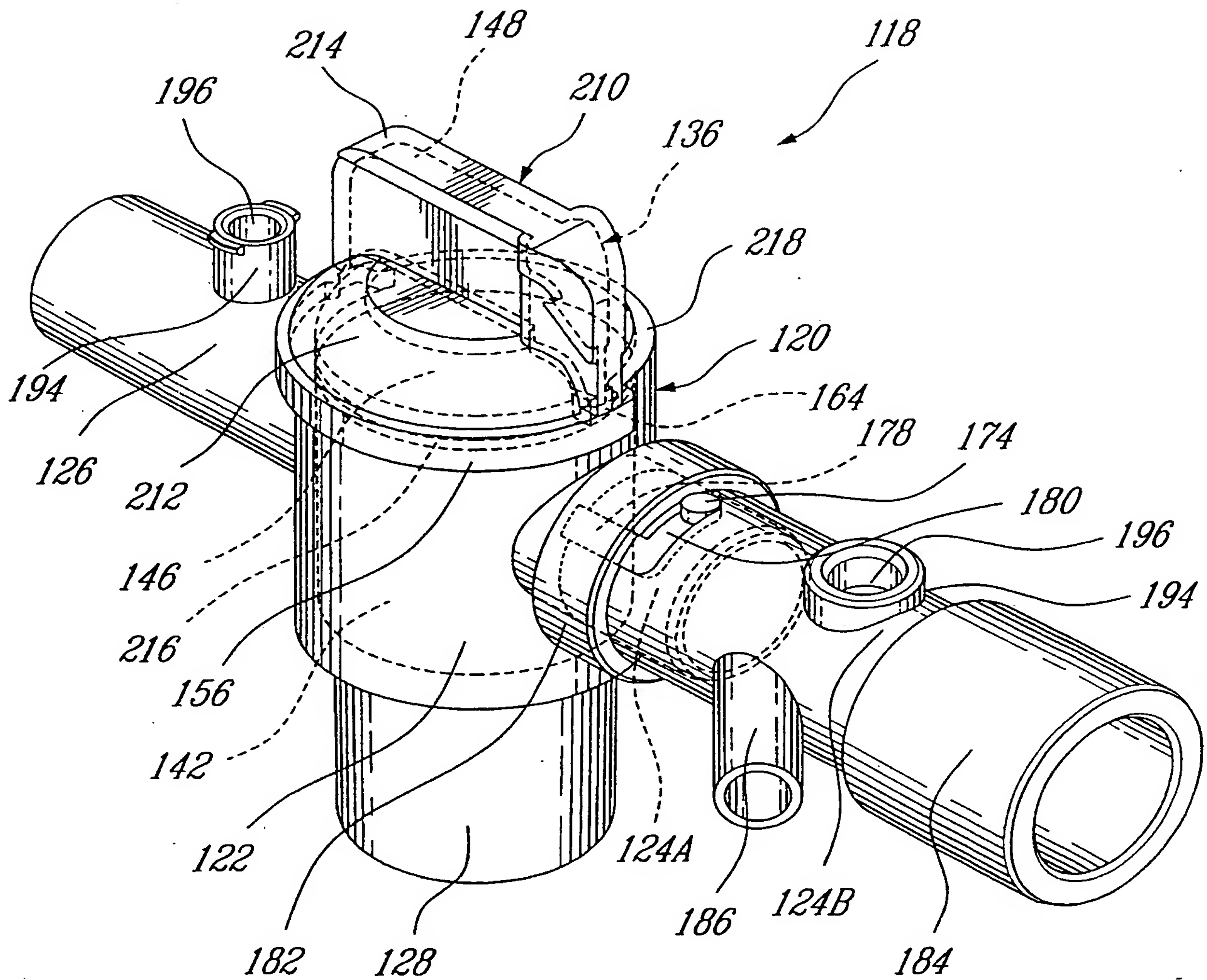

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FIG. 8

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/CA 99/01040

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61M16/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 195 39 655 C (UNIV SCHILLER JENA) 12 September 1996 (1996-09-12) column 1, line 46 -column 2, line 52; figures	1,42
A	EP 0 714 669 A (INSTRUMENTARIUM OY) 5 June 1996 (1996-06-05) column 3, line 39 -column 4, line 4; figure 1	1,42
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 March 2000	04/04/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Zeinstra, H

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International Application No
PCT/CA 99/01040

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 051 847 A (HENKIN MELVYN LANE) 4 October 1977 (1977-10-04) column 6, line 14 -column 8, line 10; figures 1-3	1,42

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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